Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/GB05/000313

International filing date: 28 January 2005 (28.01.2005)

Document type: Certified copy of priority document

Document details: Country/Office: GB
Number: 0401863.6
Filing date: 28 January 2004 (28.01.2004)

Date of receipt at the International Bureau: 02 March 2005 (02.03.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

PCT/GB2005/0313

INVESTOR IN PEOPLE

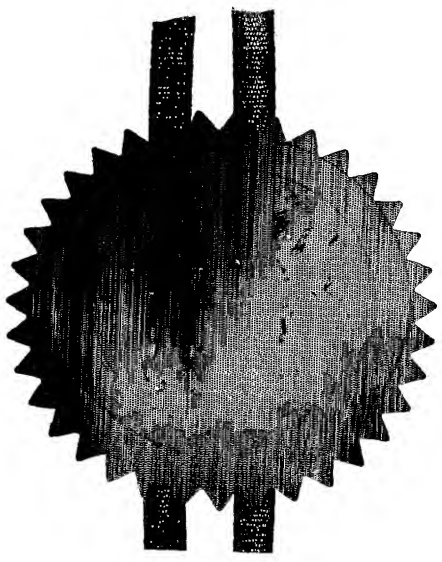
The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed A W Brewer

Dated 10 February 2005

29JAN04 E869060-1 D00085
P01/7700 0.00-0401863.6 NONE

Patents Form 1/77

Patents Act 1977
(Rule 16)

The Patent Office

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
South Wales
NP9 1RH

1. Your reference — SP/VC/158 GB

2. Patent application number *(The Patent Office will fill in this part)* — 0401863.6

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

IBIS INTEGRATED BINDERY SYSTEMS LTD
7 YORK WAY
LANCASTER ROAD
CRESSEX BUSINESS PARK
HIGH WYCOMBE
BUCKS HP12 3PY

Patents ADP number *(if you know it)* 7777956003

If the applicant is a corporate body, give the country/state of its incorporation — UNITED KINGDOM

4. Title of the invention — PROCESS FOR BINDING SHEETS

5. Name of your agent *(if you have one)* — STEVENS HEWLETT & PERKINS

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

HALTON HOUSE
20/23 HOLBORN
LONDON
EC1N 2JD

Patents ADP number *(if you know it)* — 1545003

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	9
Claim(s)	1
Abstract	0
Drawing(s)	5 ~~7~~

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature Stevens Hewlett & Perkins Date 28/01/04

12. Name and daytime telephone number of person to contact in the United Kingdom SARAH PERKINS 0207 404 1955

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.*

b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

f) *For details of the fee and ways to pay please contact the Patent Office.*

PROCESS FOR BINDING SHEETS

This invention relates to the field of printing, in particular to a process for binding individual sheets to form a book or section of a book.

Digital printing technology allows a printed image to be changed on each consecutive sheet supplied to the printer without stopping the printer to fit a new printing plate. This means that the sheets of a book can be printed in sequence. Digital printing therefore offers the potential for rapid collation of consecutive printed sheets into books or booklets. Alternative (more conventional) technologies, for example offset lithographic printers, adopt an approach in which a particular sheet of the book is printed the requisite number of times before moving to the next sheet. The individual sheets of the conventionally-printed book are only subsequently collated. Digital printers are able to print short and medium sized runs of printed material far quicker and at lower cost than previously possible.

An in-line digital printing and book-binding apparatus is described in PCT patent application WO 01/34403A. In this, and other prior art digital printing systems, a continuous web is output from a printer, each sheet of the book having two pages printed on each surface. To produce the finished book the printed web must be cut into sheets and the sheets folded, collated, covered, stitched and trimmed. The order of these operations may be varied, and this has led to the development of a variety of apparatus assemblies suitable for implementing one or more process steps for any particular stage of book production.

In conventional book binding machines, books are assembled by dropping different printed sheets onto a moving transport conveyor from a series of feed hoppers. By loading the first hopper with sheet 1, the second with sheet 2, etc., this ensures that the resulting piles of sheets delivered out on a transport conveyor contain sheets in the correct sequence. By

way of contrast, digitally printed sheets are already output from the printer in their correct order and this enables the benefits of a fixed-position sheet collector to be realised. Fixed-position collectors basically stop each individual sheet, allow the next sheet to be delivered on top of the previous sheet and, when all the sheets within one book have accumulated together, push these sheets out of the collector. Compared with conventional sheet collectors, such fixed position collectors are simpler, more reliable, have fewer moving parts, are less liable to malfunction and breakage and may be fed directly from the printer. The advance in digital printing has accordingly lead to the development of novel collation and binding methods that exploit the opportunities offered by a printing process that produces consecutive sheets in their correct order.

It is an object of the present invention to provide an alternative binding mechanism that is capable of offering an overall improvement to the quality of binding for digital production of books or booklets.

Accordingly the present invention provides a process for binding sheets together, the binding process comprising the steps of: feeding successive individual sheets to a folding apparatus; folding each sheet along a fold line; stacking successive sheets such that the fold lines of each sheet are substantially aligned characterised in that adhesive is applied to the inside of the fold line of the second and subsequent sheets prior to stacking.

In an alternative aspect the present invention provides binding apparatus for binding sheets together, the apparatus comprising: sheet folding apparatus for individually folding sheets along a fold line; and a sheet collator for stacking successive sheets such that the fold lines of each sheet are substantially aligned characterised by further comprising an adhesive applicator for applying adhesive to the inside of the fold line of the second and subsequent sheets prior to stacking.

Thus, with the present invention as adhesive is applied to the inside of the fold lines of each sheet prior to the sheets being stacked the risk is significantly reduced of adhesive accidentally coming into contact with regions of a sheet other than its fold line. Moreover, the structure of the fold line in the sheet acts as a natural barrier to movement or flow of the adhesive away from the fold line.

An embodiment of the invention will now be described with reference to the accompanying drawings.

Figure 1 is a schematic diagram of an in-line binding process according to the present invention;

Figure 2 illustrates a first stage in the process of the present invention in which a flat printed sheet is accurately folded along a central line;

Figure 3 illustrates a second stage in which glue is applied to a folded sheet;

Figure 4 illustrates a third stage in which glued sheets are collated on sheet collector apparatus to form a book or part thereof;

Figure 5 is an end on view of a sheet transport extension for use in an in-line binding process according to the present invention; and

Figure 6 is an end on view of a pressing down anvil for use in an in-line binding process according to the present invention; and

Figures 7a-f show the various stages in the sheet collection part of the process.

Figure 1 illustrates an in-line book assembly apparatus in which printed sheets leaving a digital printer are carried by a conveyor, or other transport system, through apparatus adapted for the various stages of book assembly.

With reference to Figure 1, the first stage in the in-line binding process comprises cutting a digitally printed web 1 into individual sheets 2, each sheet 2 having the requisite size and shape such that each sheet 2 has two pages printed on each surface. Once the individual sheets 2 have been cut, they are transferred to the conveyor 4. The conveyor 4 delivers the individual sheets 2 to a pair of scoring wheels 5 positioned centrally above and below the conveyor 4. The conveyor 4 accurately registers each sheet 2 against the adjustable side guide 6 so as to position the centre of the sheet 2 exactly in line with the scoring wheels 5. At the end of conveyor 4 the centre of the individual sheets 2, about which the sheets 2 are to be folded, lies parallel to the direction of travel and exactly aligned with the scoring wheels 5. Thus, as an individual sheet 2 passes though the pair of scoring wheels 5, a fold line is accurately scored across the centre of the sheet 2.

From the scoring wheels 5, the individual sheets 2 are fed into a folder 10 in which the sheets are folded to form two pages of a book, whereby for example, each page has text printed on each side thereof.

The folder 10 includes a series of folding belts 7,8 and a pair of nip wheels 9. The folding belts 7,8 are conventional in construction and arrangement, and consist of two upper, side belts 7 that are downwardly angled with respect to the feed direction and a lower, central belt 8. In addition to folding the individual sheets, though, the belts are also used to drive the pair of nip wheels 9. As a sheet 2 is carried forward by the folding belts 7,8, the side belts 7 urge the sides of the sheet inwards and downwards by virtue of the twist in the belts towards the nip wheels 9. In

this manner a sheet 2 passing into the folder 10 is folded in half with each side hanging down over the central belt 8. The pair of nip wheels 9 are provided immediately after the folding belts 7,8 to further define the fold in the sheet 2. The nip wheels 9 are positioned so as to engage each side of the sheet 2 immediately adjacent the fold line and are arranged to press the sides of the sheet together. The folder 10 further includes a sheet transport extension 20. After leaving the nip wheels 9, each folded sheet 2 is then fed to the sheet transport extension 20, which applies glue to the inside of the fold line for every sheet except the first sheet 2 of each book or portion of a book passing through the folder 10. As can be more clearly seen from Figure 5, the sheet transport extension 20, which is similar in structure to a saddle, incorporates two low friction support surfaces 21 and 22 which are separated along their upper edges by a slot 40 and arranged such that they depend downwardly and outwardly from each other to form a broken inverted V-shape, in section. The sheet transport extension 20 includes inner rotating rollers 44 and 45 and outer rotating rollers 44a and 45a which move each sheet through the extension 20, whilst ensuring that each sheet fold passes exactly over the centre of slot 40.

The sheet transport extension 20 further includes a glue applicator 23. The glue applicator 23 is situated between the support surfaces 21 and 22 and is aligned with the gap 40 such that the nozzle 23a of the glue applicator 23 is positioned to apply cold glue exactly along the inside of the fold line in the sheet 2. The glue is preferably applied as a line of individual dots of glue. It is to be appreciated, though, that hot glue, or a continuous line of glue may be applied in the alternative. Each folded sheet then passes directly into the sheet collector 15.

The collector 15 allows one complete book (or book section) to accumulate before this book (or book section) is pushed out of the collector 15. A backstop 41 locates the leading edge of each sheet as the sheet is delivered to the collector and has a reciprocating knock-up finger 43 to

ensure that as the sheets are stacked on top of each other, the sheets are in register with one another. The backstop is manually adjustable to accommodate different spine lengths or it may be automatically adjusted under the control of a central control unit 24.

A front stop 42 is also fitted to locate the trailing edge of each sheet as the sheet is delivered to the collector to further ensure that as the sheets are stacked on top of each other, the sheets 2 are in register with one another.

Each sheet 2 falls under gravity on top of the preceding sheet. Every sheet 2 delivered into the collector 15, apart from the first, has glue applied to the inside of the fold line thereof, as a result of its passage through the sheet transport extension 20 of the folder 10.

A sensor 25 is positioned on the sheet conveyor 4 and is used to scan the index markings (bar codes) printed on the sheets in order to identify the last sheet of a book. When the last sheet is identified by the sensor 25, after a short delay to allow the last sheet time to arrive in the collector 15, the fingers 17 and 18 extend as shown in Figures 7a-f in order to support the next sheet, which is the first sheet of the next book.

Whilst one or more sheets are being stacked onto the extended fingers 17 and 18, the previous stack of sheets (representing a book or part of a book) are pushed out of the collector 15 by the book conveyor 19. As can be seen from Figure 1 in particular, cover sheets 27, if used, simultaneously pass through the various stages of the process in a similar manner, either on top of one of sheets 2 or in the gaps between sheets 2. Each cover sheet 27 may also have glue applied to the inside of its fold, and arrives in a position so that it can be laid over the top of the stack of sheets in the sheet collector 15.

The collector 15 further includes a pressing down anvil 28 which is shown more clearly in Figure 6. The anvil is situated above the apex of the sheet stacking region and hence is also aligned with the fold lines of any sheets being stacked. The anvil 28 is movable downwardly to engage the spine of the fold lines of the sheets being stacked in the event there is an interruption in the input sheet stream. Thus, in the event of an interruption in the sheet supply stream the anvil 28 is moved to apply downward pressure to the fold lines of the sheets 2 to ensure full adhesive contact between individual sheets in the stack. The contacting surface of the anvil 28 is shaped so as to generally correspond to the V-shaped folded sheets in the stack of sheets

Activation of the anvil 28 is initiated by the detection of an interruption in the supply of sheets to the collector 15. The detection of an interruption is preferably by means of a sensor upstream from the folder 10.

Once all the glued sheets of the book (including a separately fed cover, if applicable) are in place on the arm 16, the conveyor 19 moves forward and a pusher finger 29 projecting upwardly from the conveyor 19 to above the arm 16 engages the edge of the stack of sheets and pushes the stack forward off the arm 16 onto the saddle 33.

The cover feeder 26 is only required to be used when the cover to the book is in a different material, for example laminated, or is printed in colour whereas the remainder of the book is printed in monochrome. The cover feeder 26 has a table 30 on which the cover sheets 27 are stacked. From the table 30 each cover 27 is fed individually using a vacuum separation system 39 and then registered and centred with respect to a pair of scoring wheels 5. The covers are fed through the scoring wheels 5 to define a fold line for the covers. The scored covers are then fed to folding belts 7 and to nip wheels 9 downstream from the folding belts 7, and to sheet transport extension 20 which applies the glue to the inside of the

fold in the cover 27 in a similar fashion to the sheets 2.

Alternatively, if the cover 27 is to be fed on top of the sheet 2, then the underside of cover 27, or the upper side of sheet 2, may receive a line of glue prior to cover 27 and the sheet 2 coming together as they enter scoring wheels 5.

In this way each cover 27 is folded, has glue applied to it and is introduced over the top of a stack of sheets in the collector 15. Sensors (not shown) may be used to automatically monitor the size and shape of the covers so that the score line in the cover is accurately positioned centrally to the cover. Alternatively, fine adjustment may be performed manually.

The backstop 41 and front stop 42 in the sheet collector 15, plus the reciprocating knock-up finger 43 conveys ensure the covers and the other sheets within each book are registered , preferably within 0.2 mm. The backstop 41 is adjustable so that its position may be altered to accommodate different sheet and cover lengths. Adjustment of the backstop may be performed manually or may be under the control of the central control unit 24.

The conveyor 19 moves the completed stack of sheets 2 and cover 27 forward to the book presser 31 which presses the sheets and covers together at their folds. Conveyor 19 then pushes sheets 2 and cover 27 forward to the trimming part of the apparatus where the book is trimmed to the requisite size and shape employing known techniques and apparatus.

The in-line binding process described above enables the pages of a book or the pages of a section of a book to be securely held together by means of glue. In applying glue to the inside of the fold line of the folded sheet, the risk is significantly reduced of the glue accidentally being wiped

by an adjacent sheet in comparison to a situation in which glue is applied to the outside of the fold line of the folded sheet. The reason for this is that the glue on the underside of an upper sheet will only contact the sheet below when the spine of the upper sheet settles exactly on top of the spine of the lower sheet. In this way, the likelihood of smearing of the glue being used to hold the pages together is reduced.

The process can be used for making both thick and thin glued books from digitally printed sheets. If the books are very thick then they will comprise a number of glued sections (with for example, six sheets per section) which are collected together and glued again (with hot glue) before the cover is applied. Thinner glued books will be made from one large section (up to fifty sheets for example, which are folded, glued, and collected on top of one another with a cover on top).

Further and alternative features of the in-line binding process are envisaged without departing from the scope of the present invention as claimed.

The same process may also be used for producing books where the sheets 2 and cover 27 may be bound together by the use of wire staples. In this case the cold glue nozzle 23 is inhibited and the book presser 31 is removed to be replaced with wire stapling devices. In this way books may be produced which are either glue bound or wire staple bound, both from the same machine.

CLAIMS

1. A process for binding sheets together, the binding process comprising the steps of:

feeding successive individual sheets to a folding apparatus;

folding each sheet along a fold line;

stacking successive sheets such that the fold lines of each sheet are substantially aligned

characterised in that adhesive is applied to the inside of the fold line of the second and subsequent sheets prior to stacking.

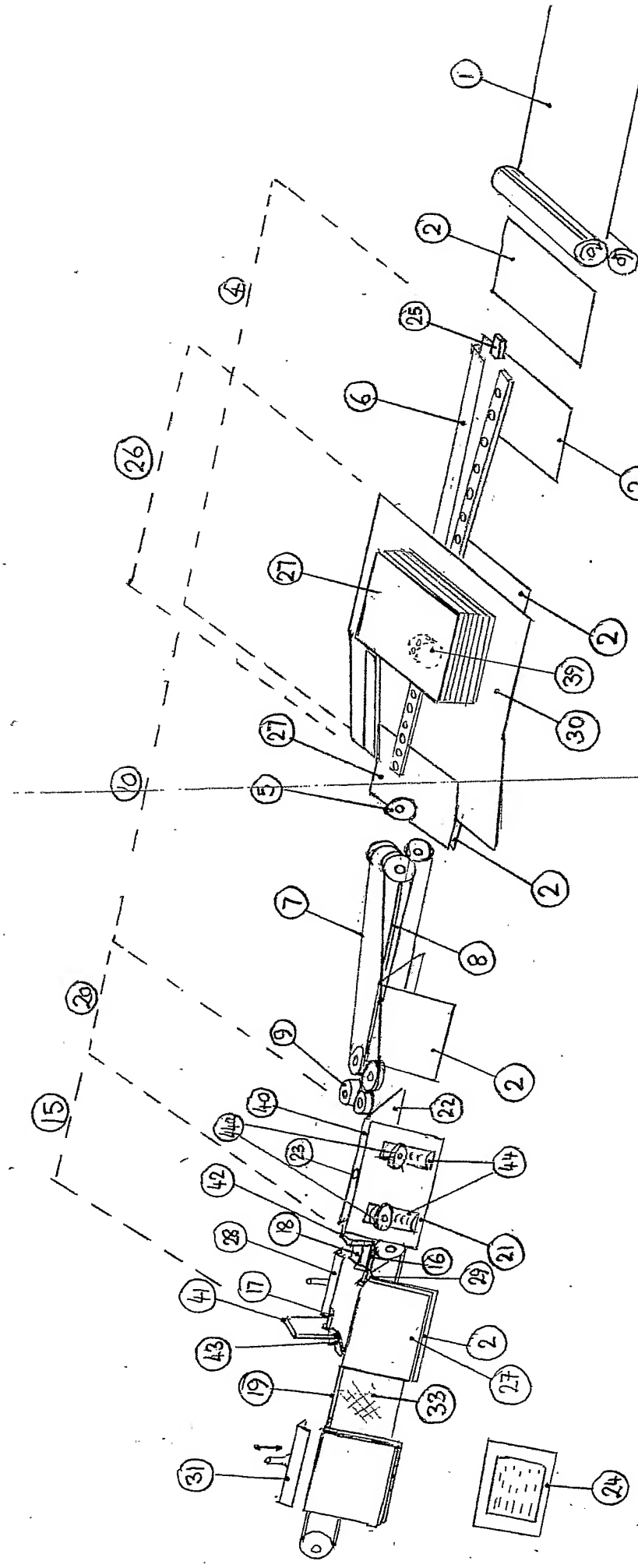
2. Binding apparatus for binding sheets together, the apparatus comprising:

sheet folding apparatus for individually folding sheets along a fold line; and

a sheet collator for stacking successive sheets such that the fold lines if each sheet are substantially aligned

characterised by further comprising an adhesive applicator for applying adhesive to the inside of the fold line of the second and subsequent sheets prior to stacking.

FIGURE 1


1
2
3
4
25
6
2
26
27
2
39
30
27
10
5
6
2
7
8
29
9
2
15
40
22
41
23
44
42
44
8
21
28
16
29
17
4
43
2
27
19
33
31
24

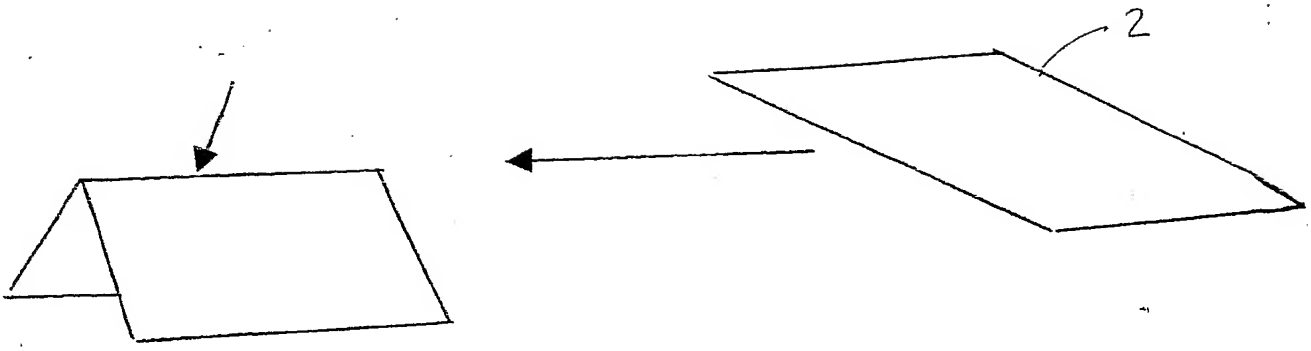


FIGURE 2

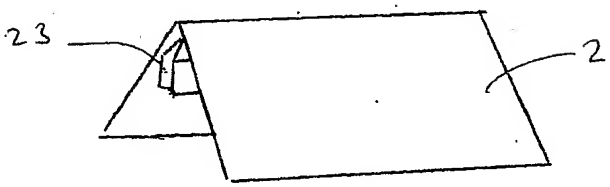


FIGURE 3

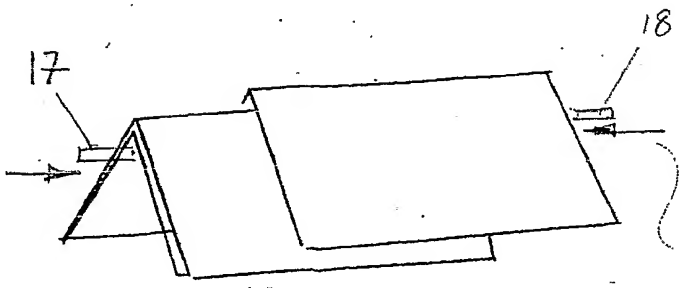


FIGURE 4

Arrows show direction of movement when extending.

FIGURE 5

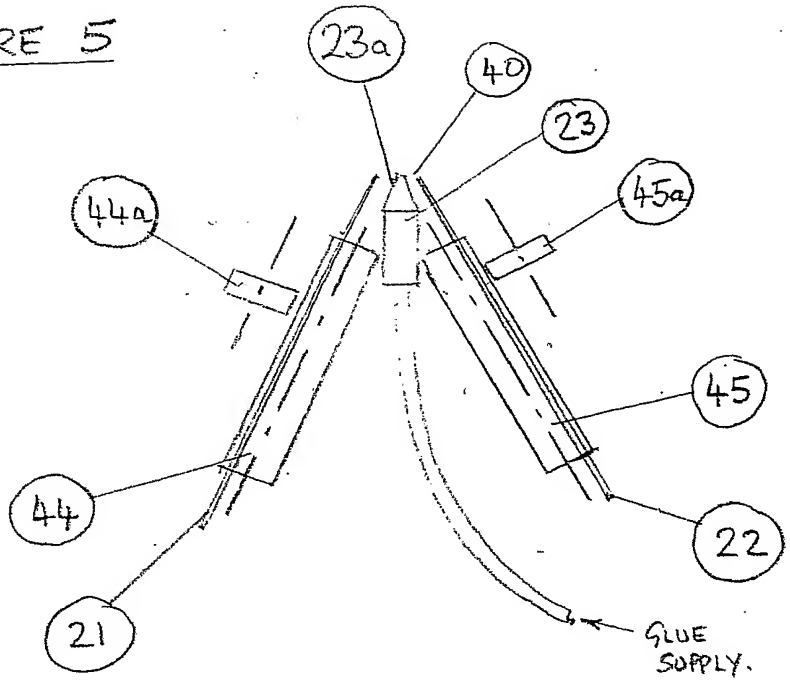


FIGURE 6

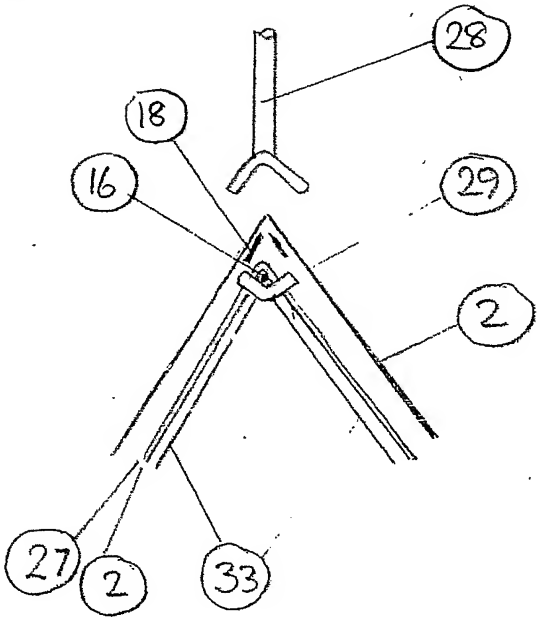


Figure 7a

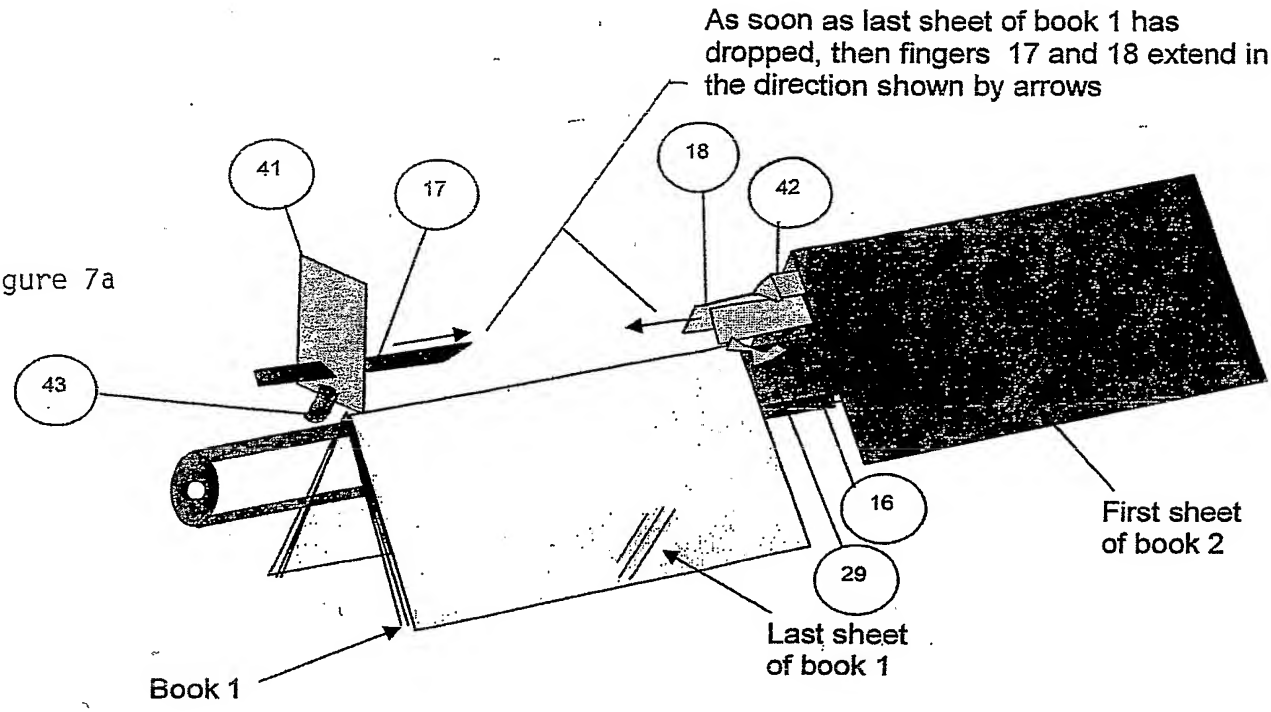


Figure 7b

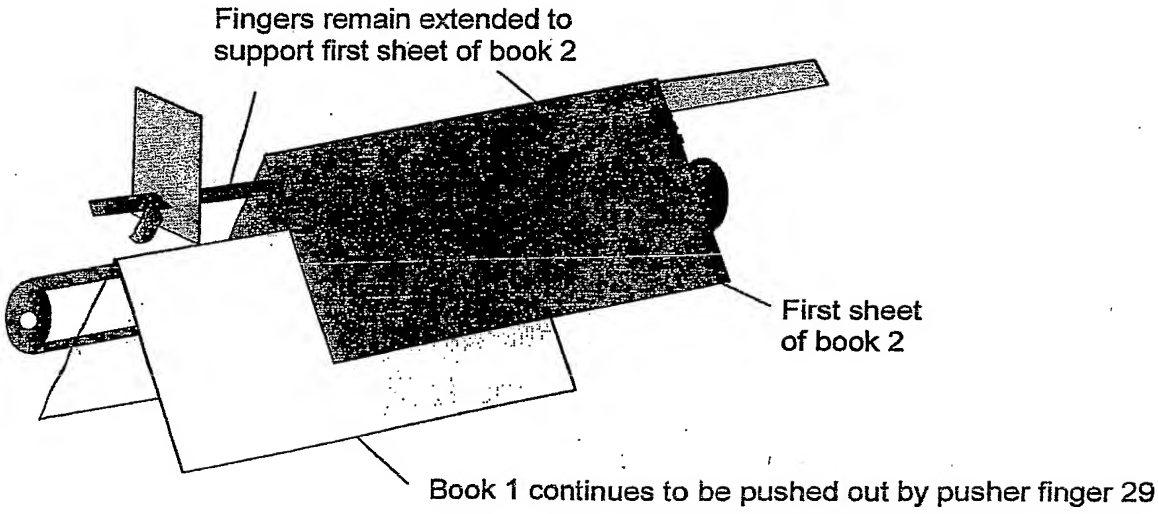


Figure 7c

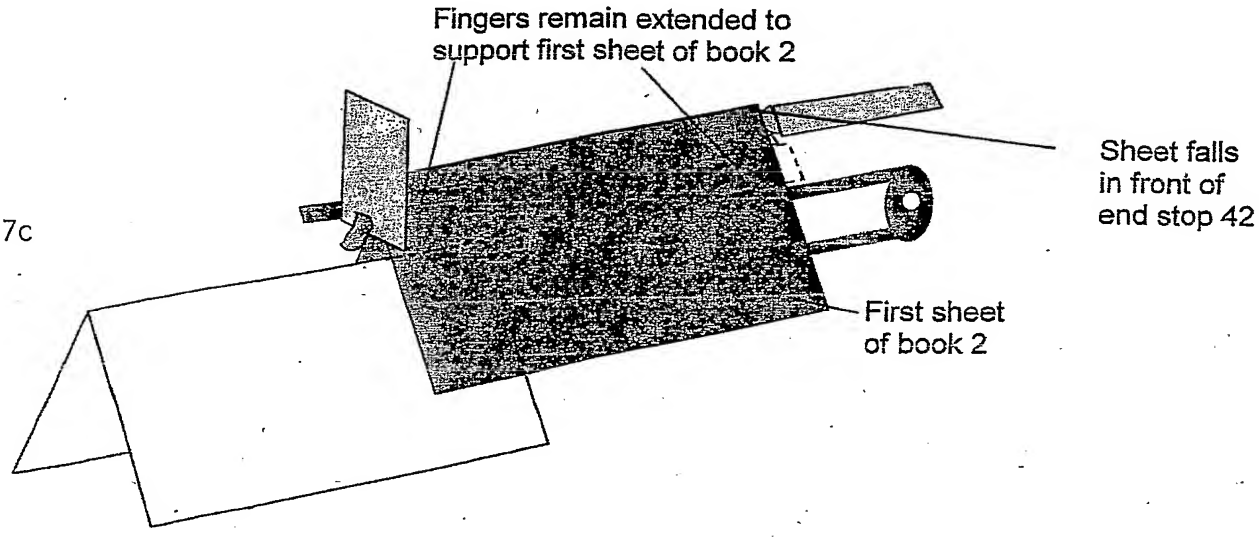


Figure 7d

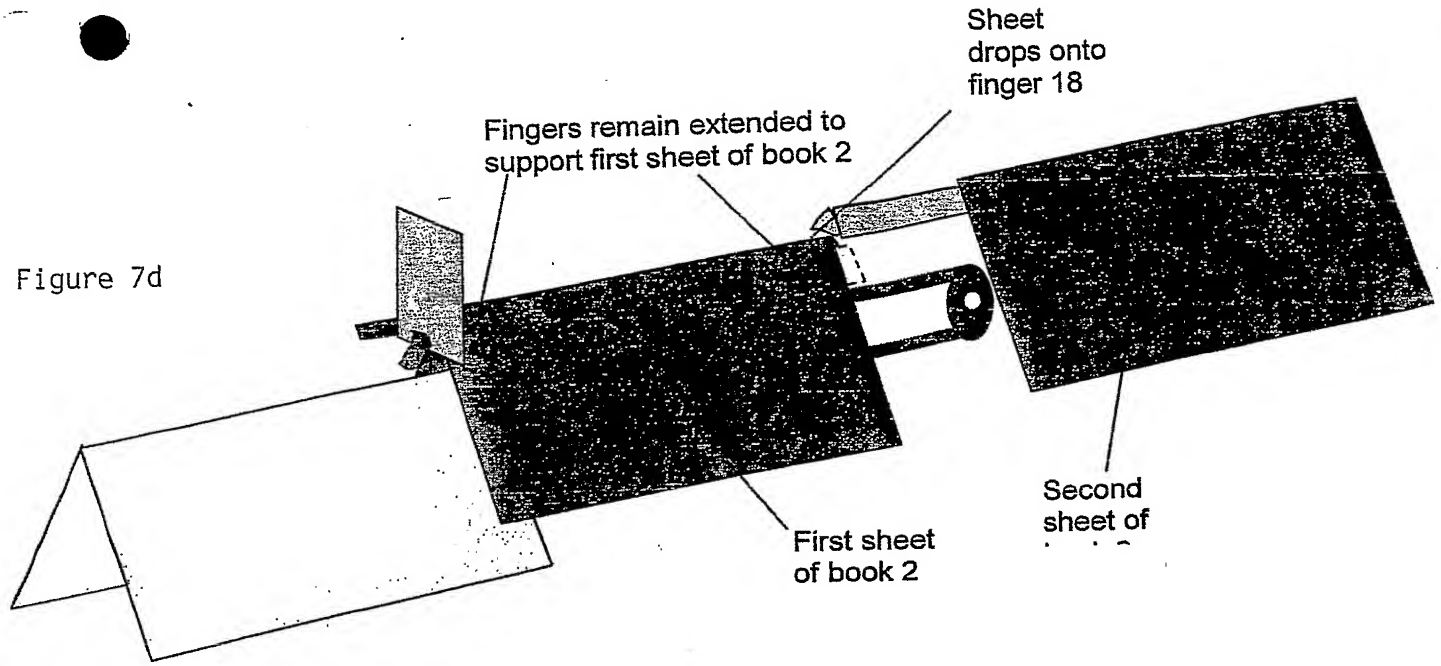


Figure 7e

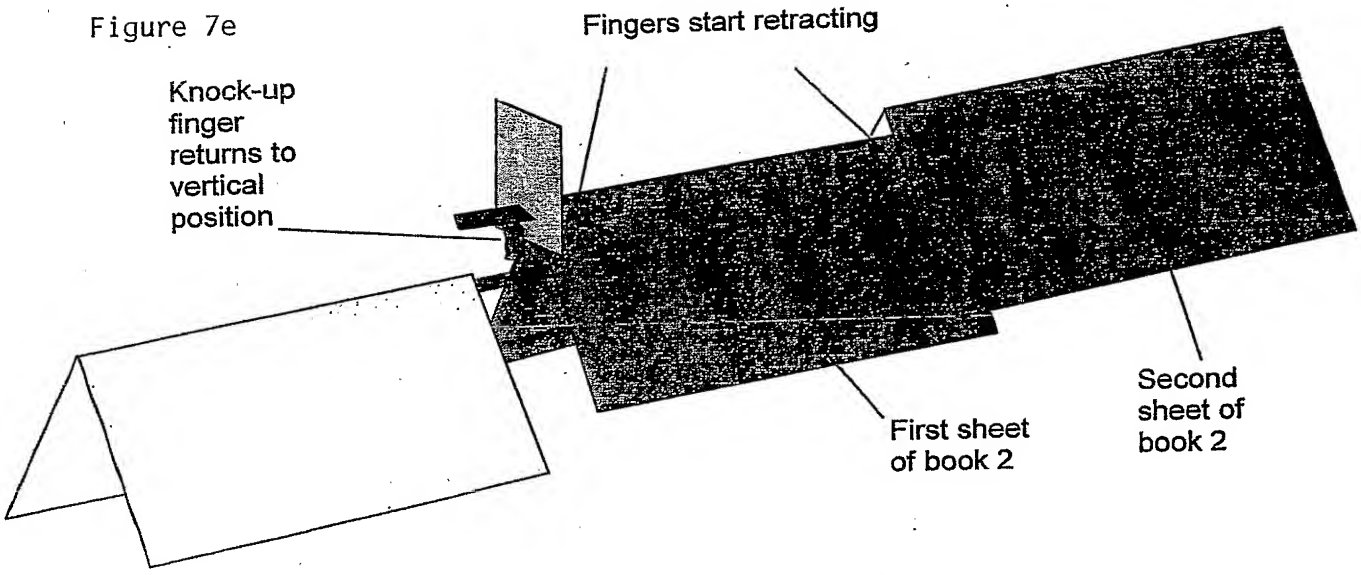


Figure 7f